



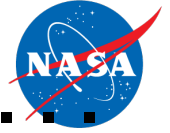
Flight Opportunities Program

- *Laguduva “LK” Kubendran / HQ – Program Executive*
 - *John Kelly / DFRC – Program Manager*

Aug 16, 2012

- *Small Sat 2012, Logan UT*

Rationale for the Program—The 100km View . . .

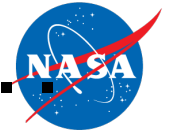


To facilitate maturation of cross-cutting space technologies for NASA's **Space Technology Program . . .**

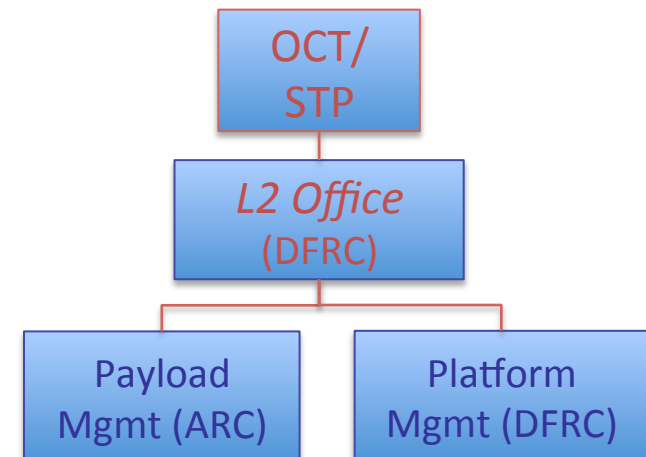
. . . while achieving a goal of the **National Space Policy*** to “Encourage and Facilitate” the growth of the U.S. commercial space industry

* http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf

Rationale for the Program—The 30km View . . .



- Utilize commercial suborbital flight supply to advance crosscutting space technologies
- Program Goals
 - Facilitate the maturation of technology payloads to higher TRL's through flights in relevant environments
 - Foster growth in the emerging commercial suborbital platform industry
 - *Fly early, Fly often.* Bridge the gap between testing space technology in a laboratory environment and demonstrating it in a mission-relevant operational environment
- Implementation
 - Established under the OCT/Space Technology Program
 - Managed by DFRC
 - 60+ years of high-speed, rocket-powered suborbital flight
 - Proven Airworthiness and Flight Safety Review process

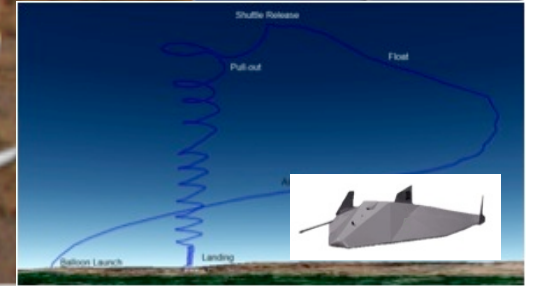


Where Do Flights Come From? . . .



- The emerging commercial suborbital transportation industry (primary)
 - NASA suborbital program platforms (if required)
- Late Spring 2011, solicited proposals for flight and payload integration from commercial reusable space industry
 - Selected seven commercial providers in Aug 2012
 - Armadillo Aerospace, Heath, Texas
 - Near Space Corporation, Tillamook, Ore.
 - Masten Space Systems, Mojave, Calif.
 - Up Aerospace Inc., Highlands Ranch, Colo.
 - Virgin Galactic, Mojave, Calif.
 - Whittinghill Aerospace LLC, Camarillo, Calif.
 - XCOR, Mojave, Calif.
- Utilize the Zero-G Corp parabolic platform through JSC's Reduced Gravity Office
- Commercial Vertical Testbed (CVTB) development
 - Draper Labs, Cambridge, MA, tasked in Sept 2011 to rapidly develop a VTVL vehicle capability to allow for quick integration and demonstration of landing technologies





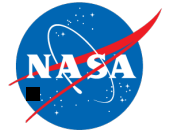
Nominal Platform Accommodations



Specification	Zero-G	Up Aerospace	Near Space	Masten Space Systems	Virgin Galactic
Vehicle Name & Type	<i>G-Force One</i> Parabolic Aircraft	<i>SpaceLoft XL</i> VTHL sRLV	<i>Hi-Alt Balloons</i> - Small/Nano - Shuttle (HASS)	<i>Xaero</i> VTVL sRLV	<i>SpaceShip Two</i> HTHL sRLV
Altitude & Flt. Frequency	11 km 40 cycles/sortie 3-4 days/wk	115 km Freq = TBD	35 km Freq = TBD	115 km Freq > daily	115 km Freq > daily
Launch Site	Ellington Field, Houston, TX	Spaceport America, NM	Tillamook, OR	Mojave Air & Spaceport, CA	Spaceport America, NM
Micro-g Environ	20 sec/cycle followed by 2g	4 min	N/A	4 min, <0.001 g	4 min, TBD
Payload Mass & Vol	> 100 kg > 27 cu ft 3-4 people	36 kg total Multiple PLs in cannisters	10 kg or 1 kg	10 kg at 30 km	600 kg 14 m ³ in 19" Racks
Power	28 vdc, 110vac	3.7 to 32 vdc	See PUG	12 or 24 vdc	See PUG

<https://flightopportunities.nasa.gov/platforms/>

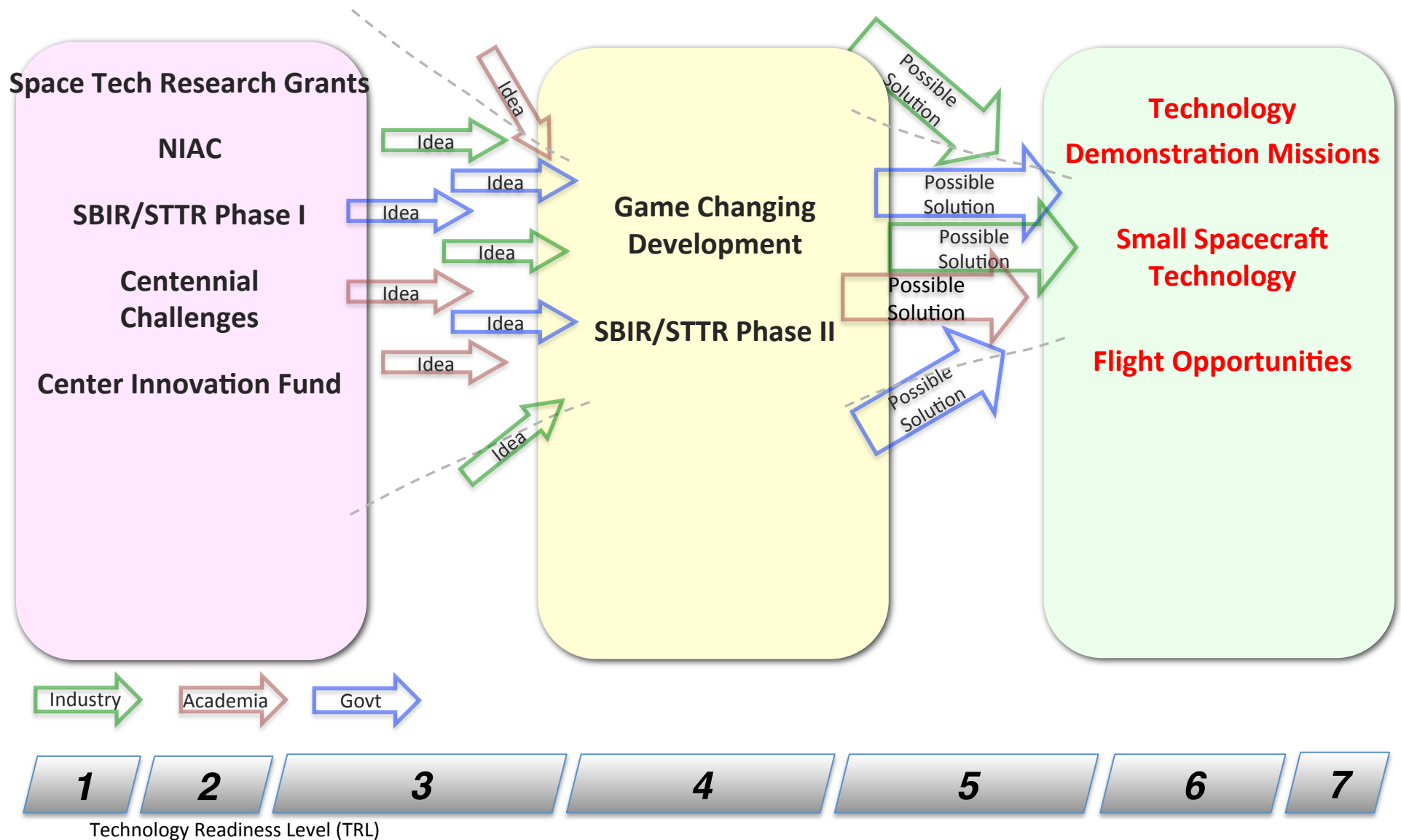
Where do Payloads Come From?..



1. Linkage to one of the Space Technology programs
2. The Announcement of Flight Opportunities (AFO)
3. The Game-Changing Development Program
NASA Research Announcement (NRA)
4. Advocacy on behalf of a NASA Mission Directorate or other government agency

Payloads come from YOU!

1. Linkage to NASA's Space Technology Program



2. Announcement of Flight Opportunities (AFO) . . .



- Released on December 21, 2010
- Open Call until December 31, 2014
 - Hosted on NSPIRES
 - <http://flightopportunities.nasa.gov/afo>
 - Evaluation criteria
 - Broad Applicability
 - Maturation Plan & Flight Test Objectives
 - Technology Readiness
 - Benefit to NASA
 - Payload Readiness for Flight
 - Experience of team
 - Awarded as unfunded Space Act Agreements or MOA's periodically (~3 to 4 times/year)

3. Game-Changing Development Program's NASA Research Announcement



- NRA Drivers
 - “Prime the Pump” to ensure technology payloads are available as sRLV flights come online
 - Promote suborbital research through enhanced capabilities on commercial platforms
- Two Topic Areas:
 - Topic 1: Payload Development for Space Technologies
 - TA02, TA03, TA08, TA09, TA12, and TA14
 - Topic 2: Engineering and Integration Demonstrations
 - Capability Enhancements and Onboard Research Facilities for Payload Accommodation
 - TA01, TA06, TA08, TA12
- 14 Awards Made totaling \$3.5M

One More Round of the NRA Planned for FY'13

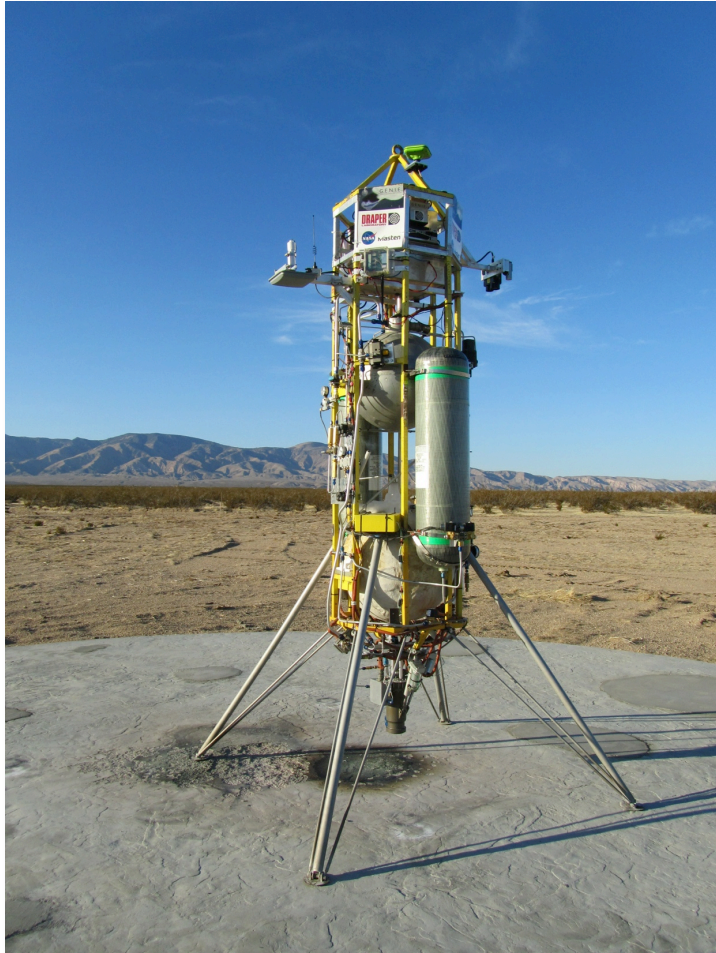
AFO #	Released	Closed	Selection	# Proposals received	# Proposals selected
Internal/ directed	-	-	-	-	3 1 parabolic + sRLV 2 sRLV
AFO 1	Dec 21, 2010	Feb 23, 2011	May 13, 2011	23 17 parabolic 4 sRLV 2 parabolic + sRLV	16 12 parabolic 2 sRLV 2 parabolic + sRLV
AFO 2	June 6, 2011	June 28, 2011	Oct 4, 2011	11 5 parabolic 5 sRLV 1 parabolic + sRLV	9 4 parabolic 4 sRLV 1 parabolic + sRLV
AFO 3	Nov 16, 2011	Dec 16, 2011	Mar 23, 2012	35 23 parabolic 7 sRLV 3 balloon 1 balloon + sRLV 1 parabolic + sRLV	24 16 parabolic 5 sRLV 2 balloon 1 balloon + sRLV
AFO 4	April 4, 2012	May 11, 2012	Aug 14, 2012	5 4 sRLV 1 balloon	2 1 sRLV 1 balloon
AFO5	Aug 10, 2012	Sept 21, 2012	November 2012	TBA	TBA
GCD NRA	Feb 10, 2012	March 26, 2012	July 2, 201	40 40 sRLV	14 14 sRLV
TOTAL TO DATE				114	68

4. NASA Mission Directorates . . .



- Direct Advocacy from the Mission Directorate to STP
- Through Mission Directorate calls
 - NASA SMD's Research Opportunities in Space and Earth Sciences (ROSES)
 - NASA SMD's Hands On Project Experience (HOPE)
 - NASA SMD's Undergraduate Student Instrument Project (USIP)
 - NASA HEOMD Human Research Program NRA NNJ12ZSA002N
 - Crew Health and Performance in Space Exploration Missions (issued July 30, 2012)

Questions?



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<http://flightopportunities.nasa.gov>

Backup Charts



Zero-G Corp (commercial aircraft)



- Parabolic flight campaigns flown 4x/year
- 20 sec/parabolas at micro-g, lunar-g, mars-g, 40 parabolas/day, 4 days/campaign, pressurized
- Payloads can be large, human-tended (3-4/team), but need to fit thru loading door w forklift



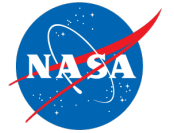
Masten Space Systems (Xaero)



- 12kg mass payload
- ~20 km average altitude based on payload mass
- Target is 100 km
- VTVL guided rocket
- Payloads must be self-contained, automated
- Pressure sealed



Near Space Corp (3 Types)



- Nano Balloon System (NBS): 1kg
- Small Balloon System (SBS): 10 kg
- Hi-Alt Shuttle System (HASS): 10 kg
 - Auto-glide from altitude to GPS waypoint
- 30-35 km altitude, unpressurized
- Up to 6 hr duration float at altitude
- Payloads automated
- Flight opportunities available now



UP Aerospace (Spaceloft)



- 36 kg to 115km
- Payloads fit in provided cylindrical payload canisters which stack
- Ballistic trajectory
- Can provide power and trigger signals to payloads
- Payloads automated
- Flight opportunities available now
- Unpressurized



Virgin Galactic (SpaceShip Two)



- 100+ km altitude, payloads mostly automated, payload compartment is pressurized
- 3+ minutes of micro-g, lunar or mars-g
- Flight in summer 2013 (approximate)

